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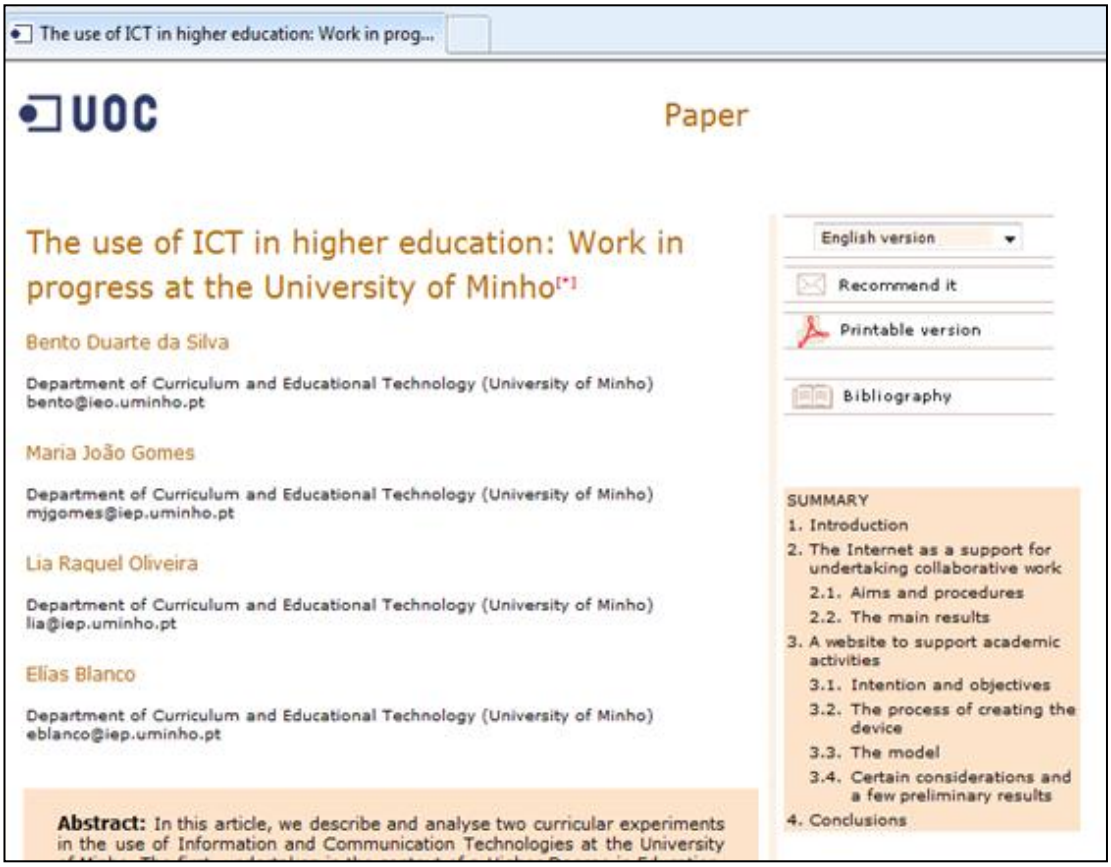

The use of ICT in higher education: Work in progress at the University of Minho[*]

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Abstract: In this article, we describe and analyse two curricular experiments in the use of Information and Communication Technologies at the University of Minho. The first, undertaken in the context of a Higher Degree in Education, in the subject of Information and Communication Technologies in Education, deals with the conception and implementation of a model that supports the development of work groups making use of the Internet. We describe the methodology of the work adopted while exploring a specific website, and analyse the main implications of its use in school practice. The second experiment, being developed in the subject of Educational Technology taught in various Teacher Training Degrees, deals with the construction of an open and flexible platform (website) providing support for learning activities. We present the student interface and discuss some of the underlying options. Finally, we reflect upon the importance of promoting the integration of ICT in education and training.

1. Introduction

Recently, the issue of pedagogics has attracted the attention of many academics and researchers from different countries, who are interested in teaching at the level of higher education. Traditionally, the paradigm of pedagogical organization in higher education, the *heir* of the medieval model, is still that of the teachers' freedom of choice, leading to their almost absolute autonomy, associated to a methodology based on authority-based and disciplinary teaching. This paradigm has revealed itself to be relatively efficient in the context of students from an elite; but in a multicultural and massified system, it very often represents a pure waste of time and resources (Santos, 2001).

In the last few decades, we have seen an increasing number of youngsters gaining access to higher education. This phenomenon reflects a trend at a global level, which is largely due to the democratisation and development of societies, the improvement of living conditions and structures, the demand for a more highly qualified performance both in professions and

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citizenship. We have, therefore, witnessed a change both in terms of quantity as well as quality in the student population, reflected in the gradual loss of the elitist and formal character of higher education through the admission of individuals from all social classes (Soares & Almeida, 2002).

Furthermore, the evolution both of society and of the work market demands that there be a change in the competence profiles of graduates. Santos (2001), referring to a set of studies dealing with this issue, sums this up by stating that what is expected of a higher education graduate is: 1. Personal attributes (which include intelligence, knowledge of a given scientific area, the will to learn throughout life, flexibility, self-regulating skills, self-motivation and self-confidence); 2. Interactive attributes (which include the ability to communicate, relate to and work within a team).

The democratisation/massification of higher education as well as new demands regarding graduate students' skills have generated profound implications in the change of the pedagogical paradigm. With respect to teaching methodologies, the paradigm must evolve towards student-centred methodologies, which make the student an active element in learning, duly guided and accommodated by effective and committed tutorial support.

In this change of paradigm, it is now impossible to ignore the potential of Information and Communication Technologies (ICT), and especially that of the Internet (Trindade, 2002). With the change from a world of atoms to a world of "bits" (Negroponte, 1995) we are witnesses to the appearance of the Information Society and its expansion through the development of computer networks, which allow citizens to access enormous sources of information, communicating at a speed never seen before, connecting to any point on the globe and asserting themselves not only as consumers of information and knowledge but also as the creators and sources of that very information and knowledge itself. As mentioned in the *Report to UNESCO of the International Commission on Education for the Twenty-first Century,* this technological revolution obviously constitutes an essential element in the understanding of our modernity, inasmuch as it creates new forms of socialization and, even, new definitions of individual and collective identity (UNESCO, 1996).

Several international bodies, with a special emphasis on UNESCO, have drawn attention to the impact which the ICT may have in the renovation of the structures within the educational system as well as on the methodologies of teaching-learning. It is within this framework that the present communication should be considered. The pedagogics of higher education cannot be disconnected from academic success and, thus, from teaching and innovation. In this article, we describe and analyse two curricular experiments in the use of Information and Communication Technologies at the University of Minho. The first, undertaken in the subject of *Information and Communication Technologies in Education* in the Higher Degree in Education, deals with the conception and practice of a support model for the development of collaborative work resorting to the Internet. The second, being developed in the subject of *Educational Technology* taught in various Teacher Training Degrees, deals with the construction of an open and flexible platform (website) providing support for learning activities. We conclude with a brief reflection on the importance of promoting the integration of ICT in education and training in a sustained and reflected manner.

2. The Internet as a support for undertaking collaborative work

In the area of Information and Communication Technologies in Education (ICTE), a subject in the Higher Degree in Education, students are asked to undertake collaborative work on the role and implications of information and communication technologies in society at large and in education, with the purpose of ensuring both reflection and a sense of cooperation in research, aspects which should be valued in an academic culture and, especially, in an Education degree.

However, there are a few specific features in higher education which restrict the applicability of the collaborative work methodology, making it difficult to proceed with the collaborative sense of learning that we would wish to implement: the extension of the syllabus, the disparity in the

geographic origins of the students, the diversity in the attendance system (about 30% of students are also employed) and the division of pupils into various classes.

Experience has shown us that each of the student groups concentrates its efforts on its own work, ignoring the themes being covered by other groups; it sometimes happens that the student group itself often does not work as a group, but rather as isolated individuals who later join up the topics that they have developed, thus constituting a piece of work similar to a "patchwork quilt".

To overcome these limitations, the work methodology was carefully reviewed, with the resulting 'ideal' being a model to support the development of collaborative work, resorting to Internet services, so as to encourage cooperative work within the group itself, between groups and between classes.

This model identifies itself with many of the educational modalities suggested by Harasim, Hiltz, Teles & Turoff (1996) for the use of the Web and took the following methodological aspects into account:

(i) the teacher would be available to provide tutorial support via the Internet (through e-mail and forums specifically created for this purpose);

(ii) students would use an electronic forum, which should be seen as a public space for the sharing and debating of ideas between the various workgroups, through the presentation of suggestions, comments, etc., relating to the various themes;

(iii) students could/should use the e-mail to communicate with members of their own group and with the rest of their classmates;

(iv) students could/should use both the electronic mail and the forum to communicate with the teacher;

(v) students could/should use the e-mail to communicate with individuals and entities exterior to the class, outside the course and outside the University, who might be able to contribute to the undertaking of assignments;

(vi) students should consider the possibility of proceeding with information research via the Internet.

To this end, a website was implemented to provide support for the undertaking of collaborative work, which would allow the students to access relevant and significant information and to communicate, through the forums and electronic mail via the Web. This site, was organized so as to make information available on the following: the aims of the site; the subject syllabus; the chronogram of activities; the identification and electronic address of the students and teacher; assignment themes and identification of the workgroups; links to research sites; glossary of terms related to the Internet and the Web; support texts related to the Internet, the Web services and E-mail; two forums for debate and discussion (forum 1 - for experiments in utilization; forum 2 - for the discussion of assignment themes being developed); a place for the publication of collaborative work, once concluded.

2.1. Aims and procedures

With the undertaking of this experiment, we aimed, on the one hand, to attain the objectives related to collaborative work and, on the other, to gather information on the feasibility of using these electronic services, from the point of view of tutorial support. As

for collaborative work, we sought to stimulate the sharing of knowledge, the promotion of the spirit of helping others and constructive criticism, the encouragement of cooperative work within the group itself, as well as between groups and between classes. As for tutorial support and the model used to aid this, we aimed to obtain data that might provide answers to the following issues:

- What advantages and/or disadvantages do students find in a model for tutorial support in which contact with the teacher is based on electronic communication services?
- What would the implications of this model be with regard to the teacher's role and activities?
- Would students use the discussion forum to collaborate with each other?
- Which are the factors that may condition student adhesion to a work model possessing the characteristics described?

The process of conception and implementation of the experiment took place over three academic years (from 1997 to 2000). Data collection was undertaken each year through electronic messages sent via the forum and/or e-mail and through a questionnaire that was passed on to the students. The methodological approach adopted when gathering and processing the information can be consulted in Gomes, Silva and Dias (1998) and in Silva (2000). In this text, we will refer only to a few reflections on the main implications of the model.

2.2. The main results

Several consistent and systematic phenomena were observed in the data collected, allowing for a reflection on five implications of the model in schooling practice:

1. Message flow generated by students
2. The teacher's role and activity
3. The problems in accessing technology
4. Issues pertaining to methodology strategy
5. The dynamics of the space-time dimension

2.2.1. Message flow generated by students

The following can be highlighted:

(i) A great number of messages was sent, providing each workgroup and each student with the opportunity to become familiar with and to follow the development of other assignments, making suggestions, comments, etc.;

(ii) The preferential use of e-mail to the detriment of the forum when contacting colleagues and classmates, clearly opting for a communication space of a private

nature, rather than a public one;

(iii) Along with messages relating to assignments, there were others of a more private and intimate content, revealing that real acts of communication take place on the Network, where individuals project their private world onto the interpersonal and social world of interaction, exchanging commitments, offers, promises, acceptances, refusals, etc. (Silva, 1998:163);

(iv) Many messages were addressed to individuals and entities outside the course and University, who responded and thus became involved. This included other teachers from the University of Minho (providing information, opinions and comments), as well as teachers from other universities, students from various courses at the University of Minho and from other universities, politicians, companies, social communication bodies and various types of associations. Thus, the students' horizons surpassed the classroom walls and campus borders, benefiting from the qualified participation of experts in a specific field.

(v) About 70% of the students' messages occurred as a result of their own initiatives. This indicator points to active participation, demonstrating an interest and willingness in adhering to the assignment. Communicative electronic mediation thus seems to favour the capacity for students to take the initiative, in contrast to the more traditional face-to-face pedagogical methods, in which students play the part of mere respondents, as noted by certain studies (Silva, 1998).

2.2.2. The teachers' role and activity

Teachers who were more directly involved in tasks, in order to respond to the volume of messages and to act in accordance with the Network's space-time principles of flexibility (communicating from anywhere and at any time), were "obliged" to install a computer with Internet access within their private residence. This decision generated personal implications for the teacher, as regards communication costs and the development of many activities during evening hours and at weekends. Thus, two issues are put forward, which must be addressed by those occupying decision-making positions in educational policy:

(i) Is it legitimate to lay the responsibility on teachers for the financial expense resulting from the purchase of a computer as well as from access to the Network?

(ii) Is it legitimate for teachers to see their timetables extended, resulting from the undertaking of activities during evening hours and at weekends, without any changes to their established timetable?

Furthermore, still on the issue of teacher activity, there is the need to highlight the students' reference to the type of support provided, some students having stated that this support was "better" owing to two aspects: it makes the accompaniment of the various phases of the assignment easier and they can obtain written answers to their requests, implying that the teacher is "clearer and more objective".

It was concluded, therefore, that the "asynchronicity" at the level of teacher/students works in favour of the students. While providing an opportunity for creating a distance in time, it allows the teacher to undertake further research and thus respond to the requests made by students in a more complete and thoughtful manner.

2.2.3. Problems regarding access to technology

The greatest problems that students were confronted with were those related to computer access and network congestion. Although the availability of computers at the University is significant, this experiment has demonstrated that, if we wish to use the Web in pedagogical methodologies, a great deal still needs to be done regarding access to technology. Technology, which is based on the flexibility of the space-time dimension, cannot afford to be subjected to bookings and fixed schedules. On the other hand, the problem relating to network congestion is largely due to the low quality of the telecommunications network in the country. This problem is aggravated by the psychological dimension that constitutes time: new technologies have based their performance on processing information at an increasingly faster pace, causing an acceleration process in time and essentially modifying our idea of duration (Colombo, 1995). As a result, if we previously spent what we thought to be a relatively short space of time undertaking a given form of communication or obtaining information, nowadays the undertaking of the same activity in the same space of time seems to be excessively lengthy. It is for this reason that the waiting period of a few seconds/minutes required to access a site is accepted with great difficulty, since the expectations are those of instantaneity.

2.2.4. Issues pertaining to methodology strategy

The undertaking of collaborative work on the Web is similar to what Harasim, Hiltz, Teles & Turoff (1996) designate as "structured activities within a group". These activities demand a more structured form of interaction, are based on the syllabus, demand negotiated learning and imply careful previous planning, an accurate definition of the objectives desired and a schedule for the tasks in hand. They may even include, if the group's dynamics deem it necessary, the appointing of an activity leader to promote and regulate the development of tasks and debate.

Although these aspects were generally established in the initial model, in the first year of adopting this work methodology it was verified that the use of the forum as a public space for discussion, directed at encouraging collaborative work between the various groups, had not met the objectives established in a desirable manner. Consequently, greater accuracy in the structuring of tasks and objectives was introduced, which led to a significant increase in the use of the forum in the subsequent two years of the experiment. From the recommendations made, some of which were suggested by the students, the following are highlighted (Gomes, Silva & Dias, 1998:413):

(i) getting to know the students' perceptions of collaborative work;

(ii) conveying to the students the idea that they will not be "penalized" for sharing ideas and suggestions and that, on the contrary, they would benefit both in their own learning as well as in the assessment of their assignments;

(iii) taking specific measures for the development of work, namely: the definition of due dates for the presentation of certain assignment phases (e.g., objectives, preliminary index, synopsis, etc.);

(iv) defining the compulsory nature of publishing messages on the forum which elucidate the main aspects/phases within each assignment;

(v) including, in the activities subjected to assessment, the relevance of messages

sent to the forum in terms of their interest and importance, with respect to the assignment themes.

2.2.5. The dynamics of the space-time dimension

As regards the advantages/disadvantages of the use of this means of communication, students have emphasised the advantage in the flexibility of the time-space as it allows them to communicate with their colleagues, with the teacher and with other individuals or entities "at any time" and "from anywhere", "in any phase of the assignment" and "with various people at the same time". In addition, they have emphasised that this flexibility is translated into any accompaniment that is "faster and prompt" since "the responses can be made as they arise", "during any phase of the assignment" and "with various people at the same time". These references confirm the manner in which Lévy (1994) conceives the anthropology of cyberspace: a space for knowledge, a non-space which arises virtually, inhabited and animated by collective intellects who seek unprecedented forms of communication.

This flexible dynamics comprises one of the greatest potentials of the Web, given the diversity of the origins and situations of the students in higher education. This work methodology supported by the Web allows us to adopt a new definition for school timetables, as proposed by Schwartz & Pollishuke (1995): one that is flexible so as both to adapt to students' needs and in order to adapt to changes in planning and programming. We are dealing here with the *unschooling* of time, removing from it the collective dimension that it presently possesses: the same time for all students. However, one needs to emphasize that a few students also consider that the Web presents disadvantages concerning the face-to-face model. They highlight, above all, the "loss of direct discussion", the "depersonalisation" that it involves and the fact that "you cannot obtain an immediate response", all of these being aspects that are enhanced and valued in social communication. In fact, the Web model is based on written communication, a format that is colder and more rational than oral communication, occurring in an asynchronous manner. And if there are those who consider this fact to be an advantage, there are also those who prefer the emotive richness of direct discussion. Between "presence" and "distance", what may be concluded is that students would like to benefit from the advantages that each modality offers regarding academic activities: the flexibility of the space-time dimension of the Web should complement the emotional richness of the face-to-face encounter. This statement confirms the observable trend of convergence between the two modalities of teaching.

3. A website to support academic activities [1]

The following experiment is situated in the context of a research-development currently under way, whose primary objective is that of discussing and understanding the process of conceiving and implementing an educational/training device at the University, making use of web technologies. We intend to use a work instrument that will enable us to undertake an essentially pedagogical and didactic analysis of this technology in the context in question, in addition to a reflection on the technical, administrative and logistical aspects of the prototype.

3.1. Intention and objectives

We thus proceeded with the conception of a website (ET Project - Educational Technology) aimed at providing support for the teaching of subject-matter at the

1. This work is financed by the Portuguese Foundation for Science and Technology (FCT), ref. SFRH/BD/1297/2000.

university. This prototype is to be used outside the classroom and/or in the classroom and serves, as a model and an example, the subject of Educational Technology in teacher training courses that takes place in a laboratory system, supported by project methodology and making use of portfolio assessment.

The purpose of the website is to make attended lessons more flexible in the context of time and space, generating a virtual environment based on "good pedagogical practices", which can be translated into the notion of community (group, a sense of belonging), sharing and the collaborative construction of knowledge. This creation of flexibility may provide students with greater autonomy in their learning process since, during their period of training, they have access to an interactive online reference for the subject they are attending and may use it in accordance with their personal characteristics (learning styles and pace).

Other more specific objectives include the way in which access to relevant information is facilitated, making thematic communication more dynamic (students-students and students-teachers), providing a contribution to the development of information literacy skills (Oliveira, 1997) and simplifying some of the teacher's tasks, of an administrative and organizational nature, thus contributing to improved quality in the process of teaching-learning.

3.2. The process of creating the device

The process of creating the device was undertaken in three phases: conception, development and implementation (analysis and assessment are currently under way).

To create the concept, we proceeded with a revision of the literature available on the subject, as well as of the research on the Web related to similar undertakings. From the analysis of available platforms (paid or free format) for "virtual lessons", we concluded that they were either too complex for the simplicity we required or that they were overly directed at long-distance teaching.

We then proceeded with preliminary research on the existence of sites possessing the required features, at Portuguese state universities, for teaching the subject used for the model (Oliveira & Blanco, 2001).

This was followed by decision-making, related to specific objectives, the subject matter to be made available and what formats to use, the way to deal with communication/aesthetics, the types of communication and interaction. The idea of "good pedagogical practices" previously mentioned was synthesized in a metaphor, inspired by the categories of narratives (since Man is a consumer/producer of stories), of elaborating a story (i.e. construction of knowledge) in a specific dimension of time and space, by someone who makes something, using the resources required to meet common objectives and depending on certain conditioning factors. The communication/aesthetic options were minimised as much as possible, respecting the criteria of simplicity, ease of use, clarity, consistency and induced credibility (Nielsen, 2000). The architecture of the final information can be seen in the following flowchart (Fig. 1):

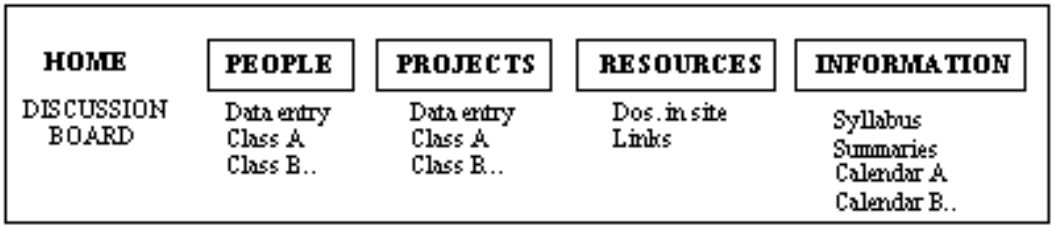

Figure 1. **Student Interface Flowchart**

The development phase—the technical execution of the site itself—counted on the collaboration of professionals from the areas of Systems Engineering and Communication Design (programming and surface structure). After elementary testing in these cases, and after installing the site, we undertook usability tests, which were fundamentally based on the "think aloud" protocol, being both individual and recorded on video. A number of changes were made as a result of these tests.

The website was implemented for one semester (2002) and was used by approximately seventy education degree students (arts and science). At present, we are processing opinions gathered from these users (via questionnaires and interviews) and we expect to make these results available soon, particularly those relating to the pedagogical interest of using the model in the situation that we have defined.

3.3. The model

With respect to the system, the site has two interfaces: the student interface, or rather, the shared environment (students and teacher) and the administrator interface (teacher), which updates the information on the site and manages it. We are therefore dealing with a database whose interfaces allow for data uploading without requiring authorized access from the server. We consider this aspect to be important for real interactivity, at the level of both interfaces, so that the platform is not limited either to unidirectional communication (teacher-students) or directive discourse. Access to any of the interfaces requires login and a password.

The interface that is briefly presented here—that of the students—is made up of five sections: Home, People, Projects, Resources and Information. The sections aim to encapsulate the adopted metaphor.

The Home section, in addition to being presented as a map of the site (fuller information is made accessible after a maximum of three clicks, due to the use of the menus that appear, on all pages, when activated by the mouse) proposes a type of simplified forum—a discussion framework. A statement is discussed (suggested on a weekly basis by the teacher) and the comments introduced are click-inserted. These inserted comments may be used to start the discussion at the beginning of an attended class. The principle underlying this option is that of reflection and voluntary participation. Thus, the Home page is seen to generate interactivity and participation.

The People section allows for four entries: data entry and three classes. In the data entry, students will find a form where they fill in personal data, which becomes available on a personal page made accessible via the course page. The teacher is integrated in the page since he or she is considered to be part of the group/community, although obviously having different objectives from those of the students.

The Project section also allows for four entries: data entry and three courses. The data entry is also a form where students are asked to fill in synopses of the assignments in which they are involved. Their names (nicknames identifying them in the group) connect with their personal page.

The Resources section allows for two entries: resources on the site and external resources. The latter are traditional links of interest, which are progressively updated by students' contributions (the links are inserted by the teacher). At present, these are grouped as national and international.

The resources on the site are grouped according to the type of document: written texts, PowerPoint presentations, video extracts, still pictures and exercises (various formats). At present, these are presented in run-on pages, since it is difficult to predict the number of documents that can be inserted.

Various reference texts were made available, some versions of these in PowerPoint, assessment grids for projects to be undertaken as well as various types of performance (student participation, teacher's activity), autonomous presentations in PowerPoint, various video extracts of documents seen in the class, a set of images and a few exercises on computing tools. This possibility of insertion and the availability of multimedia documents constitute an inevitable requirement, due to their obvious advantages, in the evolutionary process that makes up learning, the representation of information in various languages or various symbolic systems (Depover, Giardina & Marton, 1998).

All the documents are posted on a new window on the browser so that they can be seen immediately and may be recorded at the source of application. Links to other sites use the same process of posting a new window on the browser, avoiding, on the one hand, an involuntary exit from this site (due to URL change) and, on the other, preserving their authorship (one of the many reasons why frames are not used).

The Information section summarizes the institutional and administrative conditioning aspects: syllabus (official for the subject), summaries and calendar (for each course). The syllabus page occupies one screen (where its summary can be found) and it is here that we can download the required file, in addition to being able to download from a specific file concerning the regulations, criteria and types of assessment for the subject. The Summary page is similar to that of the Syllabus and allows us to download from the required file. The calendar, as the name indicates, plots the activities over the time-period estimated for attendance of the subject. This is divided into months and days (on a run-on page) and presents a guiding summary for the activities to be developed.

With respect to possible forms of communication, apart from the initial discussion framework that can be used in an asynchronous or synchronous manner, priority is given to the use of electronic mail. All members of the class-community introduce their electronic mail address on their personal pages, which then becomes available for communication from this interface.

Electronic mail, as it is generally known, allows for private communication from one person to another but also facilitates communication from one to various people, simultaneously. It also allows users to send annexed files in various formats. Additionally, e-mail applications allow the establishment of rules for message reception and dispatch (e.g. various filters), as well as the filing, registration and confirmation of reception. Thus, we believe that this type of communication is the most suitable for this kind of situation, ensuring the privacy, speed and general efficiency required in the exchange of messages. Furthermore, it is through electronic mail that the transmission of assessment results will take place (formative and summative) both by the teacher as well as by the students, through the use of selective mailing lists (individual, small groups or course groups). This option is based on the fact that we consider evaluation, in any of its forms, to be a process in a given context that concerns the people involved and in which, therefore, a certain degree of discretion and private transmission should be exercised and well delineated. This, in fact, occurs formally in the traditional academic context of posting results. It is our belief that using electronic mail for this purpose, over a period of learning, can contribute to greater personalization, transparency and fairness in the assessment process itself.

3.4. Certain considerations and a few preliminary results

Using the Web as a didactic resource for schooling activities—due to its potential for communication and distribution—means that it is not only necessary to transpose study material onto the Network but that it is important above all to conceive and develop environments that will support methodologies and strategies allowing for significant learning.

From the interpretation of data obtained from the questionnaire passed on to the students who used the platform, what is immediately visible is their highly positive adhesion (over 90%), concerning all the aspects questioned. However, participation in the discussion framework and the flow of messages via e-mail were extremely reduced, not denoting a lack of interest on the part of students but rather an absence of need in the use of these communication possibilities. In fact, given the methodology and strategies implemented in lessons for this subject, students were already so involved in the assignments they were working on that the website became a reference "space", not having played a dominating role in the dynamics of communication. Furthermore, this fact was not surprising, given the nature, intentions and objectives of the platform, especially its character as a space for a virtual, parallel, complementary lesson. "Free" and voluntary use necessarily implies an intrinsic motivation of the potential users. We presume that motivation and autonomy in adults (or young adults) is not taught but may be learnt and developed if there are conditions to this effect. Epistemologically, we understand that the first of these conditions is freedom of action, which may allow for authentic and sustained individual initiative.

No technology can be educational by itself; to understand this we need only to use it (Jacquinot-Delaunay, 2001). The conception, development, implementation and evaluation of educational and training devices for the Web necessarily require profound reflection and discussion, not only concerning the computer software and communication aspects of operation of the devices themselves, but also, and above all, regarding the pedagogical, didactic and curricular purposes and intentions that support them. We hope to contribute to this discussion as well as to the interdisciplinary approach that this medium demands.

4. Conclusions

These experiments indicate that the use of ICT, namely that of the Web, contains a potential for change in the pedagogical paradigm within higher education, pointing to an increase in the quality of learning. The established process constructs a proposal as well as a pedagogical architecture, made up of human and technological action in the multiple construction network of knowing and doing, to the extent that learning in the classroom or at a distance are factors that can be combined and complemented, extracting from each model the benefits that make better learning possible. This process favours the training of skills in the four types of fundamental education referred to by the Information Society as "learning to know", "learning to do", "learning to socialize" and "learning to be" (UNESCO, 1996).

The nature of change, which the integration of the ICT promotes in pedagogical organization, affects not only the teacher but also the student. Both are required to interact in different environments and subjects, to share knowledge, to build new relationships, to build and break down information, rebuilding it within new spaces, in differentiated meanings and with new forms of organization.

The educational proposal involves a radical change, not only in the ways in which teaching and learning takes place, but also in the manner of thought and of knowledge. Dimensions already established in the area of teaching practice have altered, together with the distribution of time and space, now associated with the use of educational strategies supported by technologies that alter and amplify the dimensions of efficiency and quality in educational processes.

It is worth emphasizing that ICT activity may cause radical change in the teacher's activity as well as in that of the student. However, the real evolution lies in the change of educational culture: a culture of collaborative learning, seeking to overcome the individualistic matrix through social action, whether it be from the perspective of interaction or representation. In this field, there is still much to be done within the culture of the universities.

While deepening the issue of ICT/Information Society interaction with Information/Higher Education, we have reached the conclusion that training processes must be re-evaluated in light of a divergent conception of time and space and of its intersection, centred on a cybernetic approach to communication: new learning communities—cybercommunities, cyberschools, cybercourses—based on new and/or renewed forms of the conception, organization, attainment and assessment of different forms of learning.

URL list:

[url1]:http://brs.leeds.ac.uk/~beiwww/BEIA/ecer2002.htm

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